COPY

VERIFICATION OF TRANSLATION

I, undersigned below, hereby declare that:

My name and post office address are as stated below:

That I am knowledgeable in the English language and in the language in which the below identified U.S. Provisional Application was filed, and that I believe the attached English translation of the U.S. Provisional Application No. 60/430,191 filed on December 2, 2002 is a true and complete translation of the above-identified Provisional Application as filed.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: December 19, 2002

Full Name of the Translator: Koichi Yabana

Signature of the translator: Yabana

Post Office Address: 28-20 Shogen-cho, Hamamatsu-shi, Shizuoka-ken, Japan

[What is claimed is]

[Claim 1]

An electric motor-operated vehicle comprising:

a seat located in about the center of a vehicle body,

a loading platform located behind said seat to hold baggage,

main frame rails disposed in the longitudinal direction of said vehicle body,

a loading platform receiving frame connected to said main frame rails,

an electric motor for driving the vehicle,

batteries for supplying power to said electric motor,

a fuel cell for charging said batteries,

fuel tanks connected to said fuel cell, and

an electric motor controller for drive-controlling said electric motor,

wherein said fuel cell, batteries, and fuel tanks are mounted laterally inside the right and left side rails of said loading platform receiving frame.

[Claim 2]

The electric motor-operated vehicle according to Claim 1, wherein said fuel tanks are mounted on said main frame rails, in the central part of the vehicle width, and said batteries are mounted on right and left sides of said fuel tanks, inside said right and left side rails of said loading platform receiving frame.

[Claim 3]

The electric motor-operated vehicle according to Claim 1, wherein a partition wall is provided between said fuel tanks and batteries.

[Claim 4]

The electric motor-operated vehicle according to Claim 1, wherein said fuel cell is located in front of said fuel tanks, under said seat, and a partition wall is provided between said fuel cell and said fuel tanks.

[Claim 5]

The electric motor-operated vehicle according to Claim 1, wherein said fuel cell is located in front of said seat, and the front ends of said fuel tanks project into the space below said seat.

[Claim 6]

The electric motor-operated vehicle according to Claim 1, wherein said fuel cell is located behind said fuel tanks, and the front ends of said fuel tanks project into the space below said seat.

[Claim 7]

The electric motor-operated vehicle according to Claim 1, wherein positioning members are provided to prevent said fuel tanks from displacing longitudinally and laterally.

[Claim 8]

The electric motor-operated vehicle according to Claim 1, wherein the longitudinal axes of said fuel tanks are directed parallel to the longitudinal direction of the vehicle body.

[Claim 9]

The electric motor-operated vehicle according to Claim 1, wherein the longitudinal axes of said fuel tanks are tilted right and left and/or up and down from the longitudinal direction of the vehicle body.

[Claim 10]

The electric motor-operated vehicle according to Claim 1, wherein waste water from said fuel cell is discharged at the central part of the vehicle width.

[Claim 11]

The electric motor-operated vehicle according to Claim 1, wherein the piping connected to said fuel tanks and to said fuel

cell is laid across the right and left rails of said loading platform receiving frame and partially along said loading platform receiving frame.

[Claim 12]

The electric motor-operated vehicle according to Claim 1, wherein a fuel supply port at the end of said fuel piping connected to said fuel tanks is provided below said loading platform.

[Claim 13]

The electric motor-operated vehicle according to Claim 12, wherein said fuel supply port is located in the rear part of the vehicle body, and a fuel filler inlet of said fuel tank is directed to the front of the vehicle body.

[Claim 14]

The electric motor-operated vehicle according to Claim 12, wherein said fuel supply port is located in the rear part of the vehicle body, and a fuel filler inlet of said fuel tank is directed to the rear of the vehicle body.

[Detailed Description of the invention]

[0001]

[Field of the Invention]

The present invention relates to an electric motor-operated vehicle with a fuel cell, in particular to the layout of components related to the fuel cell in relation to the vehicle frame.

[0002]

[Prior Art]

Electric motor-operated vehicles using the fuel cell have been in practical use as golf carts and other simple vehicles for carrying objects. The electric motor-operated vehicle here is constituted with: a seat located in about the center of a vehicle body, a loading platform located behind the seat to hold baggage, main frame rails disposed in the longitudinal direction of the vehicle body, a loading platform receiving frame

connected to the main frame rails, an electric motor for driving the vehicle, batteries for supplying power to the electric motor, a fuel cell for charging the batteries, fuel tanks connected to the fuel cell, and an electric motor controller for drive-controlling the electric motor.

[0003]

The fuel cell is generally a generator that converts the chemical energy, released when water is produced by the reaction of hydrogen and oxygen, into electric energy to be taken out. The solid polyelectrolyte fuel cell (PEFC) is in practical use that is capable of generating electricity at a low working temperature range of about 70 to 90 degrees C using an ion exchange membrane as the electrolyte, and pure hydrogen, or hydrogen extracted by reforming methanol, natural gas, or gasoline, as the fuel.

[0004]

The fuel cells and other related apparatuses mounted on the electric motor-operated vehicle must be secured to the vehicle body and protected against external forces and shocks in a compact constitution.

[0005]

An electric motor-operated vehicle with the conventional fuel cell is described in the reference patent literature No. 1. While the electric motor-operated vehicle in the patent literature No. 1 is arranged that the fuel cell, fuel tanks, etc. are mounted on the two frame rails in the lower part of the vehicle body, the layout cannot be sufficient from the viewpoints of increasing the tank capacity by the efficient use of space in the vehicle body and protection against external forces. Piping layout is also unclear and no constitution is shown that is compact with sufficient strength.

[0006]

[Problems to be Solved by the Present Invention]

The present invention has been made in view of the prior

art with an object of providing an electric motor-operated vehicle to accomplish a compact layout by efficiently utilizing the space in the vehicle body, securely fixing and holding fuel cells and related apparatuses on the vehicle body, and protecting such components against external forces.

[0007]

[Means for Solving the Problems]

To accomplish the above object, the present invention provides an electric motor-operated vehicle comprising: a seat located in about the center of a vehicle body; a loading platform located behind the seat to hold baggage; main frame rails disposed in the longitudinal direction of the vehicle body; a loading platform receiving frame connected to the main frame rails; an electric motor for driving the vehicle; batteries for supplying power to the electric motor; a fuel cell for charging the batteries; fuel tanks connected to the fuel cell; and an electric motor controller for drive-controlling the electric motor; wherein the fuel cell, batteries, and fuel tanks are mounted laterally inside the right and left side rails of the loading platform receiving frame.

[0008]

With the above constitution, the vehicle body frame consists of main frame rails and a loading platform receiving frame connected to the main frame rails; and the fuel cell, batteries, and fuel tanks are located inside the loading platform receiving frame. Therefore, those devices are sufficiently protected with the vehicle body frame in a compact layout.

[0009]

In a preferable constitutional example, the fuel tanks are mounted on the main frame rails, in the central part of the vehicle width, and the batteries are mounted on right and left sides of the fuel tanks, inside the right and left side rails of the loading platform receiving frame.

[0010]

With the above constitution, since the batteries are located on both sides of the fuel tanks in the vehicle body center, weight balance is favorable. Besides, since the batteries are located near the right and left sides of the vehicle body, maintenance is facilitated.

[0011]

In a preferable constitutional example, partition walls are provided between the fuel tanks and batteries.

[0012]

With the above constitution, the partition walls are provided between the fuel tanks and the batteries, and the partition walls are fixed to the vehicle body frame to constitute a sturdy framework, which adds to the protection of the fuel tanks and related devices.

[0013]

In a preferable constitutional example, the fuel cell is located in front of the fuel tanks, under the seat, and partition walls are provided between the fuel cell and the fuel tanks.

[0014]

The above constitution makes it possible to compactly hold the fuel cell under the seat and to form a sturdy framework with the partition walls for protecting the fuel cell and the fuel tanks.

[0015]

In a preferable constitutional example, the fuel cell is located in front of the seat, and the front parts of the fuel tanks project into the space below the seat.

[0016]

The above constitution makes it possible to make the fuel tanks long and to increase the tank capacity.

[0017]

In a preferable constitutional example, the fuel cell is located behind the fuel tanks, and the front parts of the fuel

tanks project into the space below the seat.

[0018]

The above constitution makes it possible to make the fuel tanks long and to increase the tank capacity.

[0019]

In a preferable constitutional example, positioning members are provided to prevent the fuel tanks from displacing longitudinally and laterally.

[0020]

The above constitution makes it possible to fix the fuel tanks reliably to the vehicle body by means of the positioning members without the fuel tanks displacing longitudinally and laterally.

[0021]

In a preferable constitutional example, the longitudinal axes of the fuel tanks are directed parallel to the longitudinal direction of the vehicle body.

[0022]

The above constitution, with the longitudinal direction of the fuel tanks directed the same as the longitudinal direction of the vehicle body, makes it possible to place the fuel tanks while efficiently utilizing the space in the vehicle body and to increase the tank capacity by increasing the number of fuel tanks.

[0023]

In a preferable constitutional example, the longitudinal axes of the fuel tanks are tilted right and left and/or up and down from the longitudinal direction of the vehicle body.

[0024]

The above constitution, with the fuel tanks mounted aslant, makes it possible to increase the capacity of each tank.

[0025]

In a preferable constitutional example, waste water from the fuel cell is discharged at the central part of the vehicle

width.

[0026]

With the above constitution, since the waste water is discharged at the central part between both wheels, the wheels cannot run over the waste water on the road, so that the vehicle can run in a stabilized manner.

[0027]

In a preferable constitutional example, the piping connected to the fuel tanks and to the fuel cell is laid across the right and left side rails of the loading platform receiving frame and partially along the loading platform receiving frame.

[0028]

The above constitution, with the piping routed across the right and left side rails of the loading platform receiving frame, is likely to absorb vibration. Securing the piping along the loading platform receiving frame permits the piping to be firmly fixed and held, and to be protected against external forces.

[0029]

In a preferable constitutional example, a fuel supply port at the end of the fuel piping connected to the fuel tanks is provided below the loading platform.

[0030]

With the above constitution, the fuel supply port located under the loading platform is covered with the loading platform from above and protected against external forces.

[0031]

In a preferable constitutional example, the fuel supply port is located in the rear part of the vehicle body, and a fuel filler inlet of the fuel tank is directed to the front of the vehicle body.

[0032]

With the above constitution, since the fuel supply port at the piping end and the filler inlet of the fuel tank are located on opposite sides, the piping is routed long, flexible, and

likely to absorb vibration.

[0033]

In a preferable constitutional example, the fuel supply port is located in the rear part of the vehicle body, and a fuel filler inlet of the fuel tank is directed to the rear of the vehicle body.

[0034]

With the above constitution, since the fuel supply port at the piping end and the filler inlet of the fuel tank are located on opposite sides, the piping is made short, flow resistance in the piping is low, and fuel is supplied smoothly.

[0035]

[Embodiments of the Invention]

FIGs. 1 to 4 are respectively a top view, a side view, a front view, and a back view of an electric motor-operated vehicle to which the present invention is applied.

The electric motor-operated vehicle 1 comprises: a vehicle body 2; a seat 3 located in the approximate center of the vehicle body 2; and a steering wheel 4 located in front of the seat 3. The area in front of the wheels 5 are covered with a cowl 6 from above. Main frame rails 7 made of pipe material are located under the vehicle body 2. Side frame rails 12 are located outside the main frame rails 7. A loading platform 9 for holding baggage is located behind the seat 3 and above the rear wheels 8. The lower front side of the seat 3 and the sides of the vehicle body are covered with a vehicle body cowl 10.

[0036]

FIG. 5 shows the constitution of the vehicle body frame of the electric motor-operated vehicle.

The rear ends of the paired right and left main frame rails 7 disposed in the longitudinal direction of the vehicle body are interconnected through a cross member 11. To the rear end of each main frame rail 7 is secured a bracket 13. The loading platform receiving frame 14 is a three-sided frame having right

and left side rails 14a and 14b. The rear ends of the side rails 14a and 14b are respectively connected to the brackets 13. The middle portion and the front portion of the loading platform receiving frame 14 are secured and supported through struts 15 on the main frame rails 7. A floor plate 16 is placed on part of the main frame rails 7 in the front part of the vehicle body.
[0037]

FIG. 6 is a wire routing diagram of the electric motor-operated vehicle.

A brake pedal 17 is provided on the floor plate 16. The brake pedal 17 is connected to the right front wheel brake cable 18, the left front wheel brake cable 19, the right rear wheel brake cable 20, and the left rear wheel brake cable 21. An accelerator pedal (not shown) is provided on the floor plate 16 and connected to a throttle cable 22. The throttle cable 22 is connected to an electric motor (not shown). A shift cable 23 is used to switch between forward and reverse motion.
[0038]

FIGs. 7 and 8 show the constitution, in plan view and side view, of the electric motor-operated vehicle as an embodiment of the present invention.

A DC/DC converter 24 is provided in the front cowl 6, above the main frame rails 7. The DC/DC converter 24 is to step up the voltage produced with the fuel cell. The DC/DC converter 24 is preferably placed in the depression formed in the central part of the front cowl 6 as seen in front view. In this way, the air that flows over the depression as the vehicle runs can effectively cool the DC/DC converter 24 placed in the depression.
[0039]

As shown in FIG. 5 and described above, the loading platform receiving frame 14 is fixed and supported on the main frame rails 7 through struts 15 and brackets 13. A loading platform 9 is mounted and supported on the loading platform

receiving frame 14. Two hydrogen tanks 25 are placed, with their longitudinal direction parallel to the longitudinal direction of the vehicle body, behind the seat 3 and between the raised portions of the right and left main frame rails 7 (See FIG. 8). The two hydrogen tanks 25 are placed on base seats 26 and positioned not to be displaced in longitudinal and lateral directions (See FIG. 10).

[0040]

Batteries 27, two for each side, are placed on both sides of the two hydrogen tanks 25. The batteries 27 are mounted and held along inside the right and left side rails 14a and 14b of the loading platform receiving frame 14. Partition walls 28 made of plastic material (or steel sheet) are placed between the hydrogen tanks 25 and the batteries 27. The partition walls 28 serve to increase the strength of the vehicle body frame, protect the hydrogen tanks 25 and the batteries 27, and improve cooling efficiency for the batteries by guiding the air flow, introduced from the front part as the vehicle runs, to flow along the top and both sides of the batteries 27.

[0041]

A fuel cell holding section 29 is formed under the seat 3 and on the main frame rails 7 to hold the fuel cell unit 30. A cooling fan 31 is provided on the bottom of the fuel cell unit 30. Right and left sides of the fuel cell holding section 29 are open and provided with filters 32.

[0042]

A partition wall 33 of an inverted L-shape cross section in side view, made of plastic material or steel sheet, is placed between the fuel cell holding section 29 and the hydrogen tanks 25 located behind the fuel cell holding section 29. As shown in the oblique view of FIG. 9, the partition wall 33 consists of the top portion 33a and the vertical wall portion 33b. A vent opening 34 is formed in the central upper part of the vertical wall portion 33b.

[0043]

Air intake openings 35, open to the front and sides, are provided in the right and left sides and the front side of the vehicle body cowl 10. To the air intake openings 35 are attached covers (not shown) made in a louver or labyrinth structure to prevent water and foreign matter from entering.

[0044]

Part of the external air (wind caused as the vehicle runs) taken through the air intake openings 35 into the vehicle body 2 as indicated with the arrows A is drawn, through the filters 32 with the fan 31 as indicated with the arrows A1, into the fuel cell holding section 29 to cool the fuel cell unit 30. The air warmed as it cools the fuel cell unit 30 is discharged through the vent opening 34 in the partition wall 33 as indicated with the arrows B toward the hydrogen tanks 25.

[0045]

The external air taken in through the air intake openings 35 as indicated with the arrows A flows directly as indicated with the arrows A2 to cool the batteries 27. At this time, since the batteries 27 are separated from the hydrogen tank side with the partition walls 28, the batteries 27 are effectively cooled with the wind caused as the vehicle runs, and less affected with the warm air indicated with the arrows B.

[0046]

An electric motor 36 is located behind the hydrogen tanks 25, and an electric motor control unit (MCU) 37 is located behind the electric motor 36. Locating the electric motor control unit 37 as far apart as practicable from the fuel cell unit 30 makes it possible to lessen the thermal effect from the fuel cell unit 30.

[0047]

FIG. 9 is an oblique view of the partition wall disposed between the fuel cell and the hydrogen tank.

As shown and as described before, the partition wall 33

consists of the top portion 33a and the vertical wall portion 33b, with the vent opening 34 provided in the central upper part of the vertical wall portion 33b. The fuel cell unit 30 is protected from above with the top portion 33a.

[0048]

FIG. 10 is a sectional view of the area where the hydrogen tanks are placed.

Receiving plates 38 are secured to the outer sides of the right and left main frame rails 7, and the batteries 27 are placed on the receiving plates 38. The hydrogen tanks 25 are placed on the base seats 26 for preventing lateral displacement, and securely held to the base seats 26 as tightened with a holding fitting 39.

[0049]

FIG. 11 shows another example of the partition wall between the fuel cell and the hydrogen tank.

In this example, the partition wall 33 is provided, at its opening 34, with a switching cover 40 that can be switched, as indicated with the arrow C, between a deflecting position (solid line) and a straightforward position (broken line). With the cover 40 in the straightforward position (broken line), heated air to be discharged flows straight toward the inside rear of the vehicle (as indicated with the arrow E in FIG. 11 and arrows B in FIGs. 7 and 8). With the cover 40 in the deflecting position (solid line), heated air to be discharged is deflected upward to flow along the arrow D and directed toward the seat 3, so that riders on the seat 3 are warmed in the winter.

[0050]

FIG. 12 shows an example of how the hydrogen tank is laid out in another embodiment of the present invention, with the drawing (A) being a plan view and (B) a side view.

In this example, the hydrogen tank 25 is placed at an angle to the longitudinal direction of the vehicle body as seen in both plan and side views, drawings (A) and (B). In this way,

the tank of a large capacity can be mounted in a limited space.
[0051]

FIG. 13 shows how the piping is routed according to the present invention.

A first fuel supply port 41 and a second fuel supply port 42 are provided at the end of a fuel pipe 43. The first and second fuel supply ports 41 and 42 are respectively provided with a check valve (not shown). The fuel pipe 43 is connected through a check valve 44 to the two hydrogen tanks 25. The filler inlet 45 of each hydrogen tank 25 is provided with a manual valve. A relief valve 46 is provided in a line branching from the pipe 43 between the two hydrogen tanks 25. A fuel drawing pipe 47 branches from the pipe 43 on the downstream side of the hydrogen tank 25 and is provided with a manual valve 55. On the downstream side of the fuel drawing pipe 47 are provided a filter 48, a pressure regulator 49, a lock-off valve 50, and a flowmeter 51. The lock-off valve 50 is an automatic valve to open when the fuel cell is used and to close under abnormal conditions such as a low pressure.
[0052]

The pipe 43 is connected to the fuel cell unit 30 on the downstream side of the flowmeter 51. Air is supplied to the fuel cell unit 30 with an air pump 53 through an air pipe 52 as indicated with the arrow F. As electricity is generated by the reaction of hydrogen from the pipe 43 and air (oxygen) from the air pipe 52, water is produced and drained through a drainpipe 54.
[0053]

DC voltage generated with the fuel cell is supplied through a DC/DC converter (booster) 24 to the electric motor control unit 37 to drive the electric motor 36.
[0054]

FIG. 14 is a plan view showing how the piping shown in FIG. 13 is laid on the vehicle body. FIG. 15 is a partial elevation

as seen from the front of the vehicle body.

As shown, the pipe 43 is routed across and along the inside of the right and left side rails 14a, 14b of the loading platform receiving frame 14 to surround the hydrogen tanks 25, while maintaining sufficient distance from them. The first and second fuel supply ports 41 and 42 are placed in positions below the rear part of the loading platform 9 and covered from above. As shown in FIG. 15, the pipe 43 is laid with several upward and downward bends. Laying the pipe 43 along a substantial length and with bends as described above increases the flexibility of the piping, makes it possible to absorb vibration and to secure the pipe 43 to the vehicle body frame in a stabilized manner.

[0055]

FIGs. 16 and 17 show how the drain pipe of the fuel cell unit is located.

As shown, the drain pipe 54 of the fuel cell unit 30 is located in the central part of the vehicle width and directed downward. In this way, water drained from the fuel cell is discharged between both of the right and left wheels, therefore, the water dropped onto the road surface is less likely to be run over with the wheels, so that the vehicle can run in a stabilized manner.

[0056]

FIG. 18 is a plan view of another example of pipe layout.

In this example, the filler inlets 45 of the hydrogen tanks 25 are located on the rear side of the hydrogen tanks 25 to shorten the pipe length. This example, like the previous example, is arranged to route the fuel pipe 43 across the right and left side rails 14a, 14b of the loading platform receiving frame 14 and with several upward and downward bends, so that the piping is provided with flexibility for absorbing vibration, flow resistance is reduced, and fuel supply is made smooth by shortening the pipe length.

[0057]

FIGs. 19 and 20, plan view and side view, show another embodiment of the present invention.

This embodiment is arranged with the fuel cell unit 30 located in front of the seat 3. This makes it possible to arrange that the front ends of the hydrogen tanks 25 project to the position under the seat 3 to increase the tank capacity. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0058]

FIGs. 21 and 22 show still another embodiment of the present invention in plan view and side view.

This embodiment is arranged with the fuel cell unit 30 located behind the hydrogen tanks 25. In this way, the front ends of the hydrogen tanks 25 are made to project under the seat 3 to increase the tank capacity. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0059]

FIGs. 23 and 24 show still another embodiment of the present invention in plan view and side view.

This embodiment is arranged that the electric motor 36 is located in a lowered position on which the fuel cell unit 30 is located. In this way, the front ends of the hydrogen tanks 25 are made to project under the seat 3 and the rear ends are also made to extend rearward, so that the tank capacity is further increased. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0060]

[Effects of the Invention]

As described above, this invention is arranged with the vehicle body frame consisting of the main frame and the loading platform receiving frame connected to the main frame. Since the fuel cell, batteries, and fuel tanks are located inside the loading platform receiving frame, the above devices are sufficiently protected and their layout is made compact.

[0061]

According to the constitution in which the fuel tanks are mounted on the main frame in the central part of the vehicle width and the batteries are mounted on both sides of the fuel tanks and inside the right and left side rails of the loading platform receiving frame, the batteries are located on both sides of the fuel tanks located in the vehicle body center, weight balance is favorable. Since the batteries are located near the right and left sides of the vehicle body, maintenance work is facilitated.

[0062]

According to the constitution with the partition walls provided between the fuel tanks and the batteries, the vehicle body frame is reinforced by securing the partition walls, and the related devices such as the fuel tanks are protected with the partition walls.

[0063]

According to the constitution with the fuel cell located in front of the fuel tanks and under the seat, and with the partition wall provided between the fuel cell and the fuel tanks, the fuel cell is housed compactly under the seat. The partition wall provided between the fuel cell and the fuel tanks reinforces the vehicle body frame to be sturdy, and protects the fuel cell and the fuel tanks.

[0064]

According to the constitution with the fuel cell in front of the seat and with the front ends of the fuel tanks projecting

under the seat, the fuel tanks are made long to increase the tank capacity.

[0065]

According to the constitution with the fuel cell behind the seat and with the front ends of the fuel tanks projecting under the seat, the fuel tanks are made long to increase the tank capacity.

[0066]

According to the constitution with the positioning member for preventing the fuel tanks from displacing in longitudinal and lateral directions, the fuel tanks are securely held to the vehicle body.

[0067]

According to the constitution with the hydrogen tanks placed parallel to the longitudinal direction of the vehicle body, the internal space of the vehicle body is used efficiently to increase the number of the fuel tanks and increase the tank capacity.

[0068]

According to the constitution with the hydrogen tank placed at an angle to the longitudinal direction of the vehicle body as seen in both plan and side views, the capacity per tank is increased.

[0069]

According to the constitution in which the drain water from the fuel cell is discharged in the central part of the vehicle width, the drain water is discharged onto the road between both wheels, the wheels cannot run over the drain water on the road, so that the vehicle can run in a stabilized manner.

[0070]

With the constitution in which the piping connected to the fuel tanks and the fuel cell is laid to span the right and left side members of the loading platform receiving frame and also partially extend along the loading platform receiving frame,

vibration is likely to be absorbed and the piping is securely held to the loading platform receiving frame and protected against external forces.

[0071]

With the constitution in which the fuel supply port, of the fuel pipe end connected to the fuel tank, is located under the loading platform, the fuel supply port is covered with the loading platform from above and protected against external forces.

[0072]

With the constitution in which the fuel supply port is located in the rear part of the vehicle body while the filler inlet of the fuel tank is directed toward the front of the vehicle body, since the fuel supply port at the pipe end and the filler inlet of the fuel tank are located opposite each other, the piping is routed along a long distance to increase flexibility and vibration is likely to be absorbed.

[0073]

With the constitution in which the fuel supply port is located in the rear part of the vehicle body while the filler inlet of the fuel tank is directed toward the rear of the vehicle body, since the fuel supply port at the pipe end and the filler inlet of the fuel tank are located opposite each other, the piping is routed along a short distance to reduce flow passage resistance and to supply fuel smoothly.

[Brief Description of the Drawings]

FIG. 1 is a top view of an electric motor-operated vehicle to which the present invention is applied.

FIG. 2 is a side view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 3 is a front view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 4 is a rear view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 5 shows the vehicle body frame constitution of the electric motor-operated vehicle of the present invention.

FIG. 6 is a wiring diagram of the electric motor-operated vehicle of the present invention.

FIG. 7 is a plan view of an embodiment of the present invention.

FIG. 8 is a side view of the embodiment shown in FIG. 7.

FIG. 9 is an oblique view of a partition wall of the embodiment shown in FIG. 7.

FIG. 10 is an explanatory view of the base seats of the embodiment shown in FIG. 7.

FIG. 11 shows another example in cross section of the partition wall between the fuel cell and the hydrogen tank.

FIG. 12 shows how the hydrogen tanks are mounted in another embodiment of the present invention.

FIG. 13 shows the piping system of the present invention.

FIG. 14 shows the piping routed on the vehicle body shown in FIG. 13.

FIG. 15 is a partial front view of the piping shown in FIG. 14.

FIG. 16 is a plan view of the drain pipe of the fuel cell of the present invention.

FIG. 17 is the side view of the drain pipe shown in FIG. 16.

FIG. 18 is a plan view of another example of the piping layout.

FIG. 19 is a plan view of another embodiment of the present invention.

FIG. 20 is a side view of the embodiment shown in FIG. 19.

FIG. 21 is a plan view of another embodiment of the present invention.

FIG. 22 is a side view of the embodiment shown in FIG. 21.

FIG. 23 is a plan view of another embodiment of the present invention.

FIG. 24 is a side view of the embodiment shown in FIG. 23.

[Description of Symbols]

1: electric motor-operated vehicle 2: vehicle body 3: seat 4: steering wheel 5: front wheel 6: front cowl 7: main frame rail 8: rear wheel 9: loading platform 10: vehicle body cowl 11: cross member 12: side frame rail 13: bracket 14: loading platform receiving frame 14a, 14b: side rail 15: strut 16: floor plate 17: brake pedal 18: right front wheel brake cable 19: left front wheel brake cable 20: right rear wheel brake cable 21: left rear wheel brake cable 22: throttle cable 23: shift cable 24: dc/dc converter 25: hydrogen tank 26: base seat 27: battery 28: partition wall 29: fuel cell holding section 30: fuel cell unit 31: fan 32: filter 33: partition wall 33a: top portion 33b: vertical wall portion 34: opening 35: air intake port 36: electric motor 37: electric motor controller 38: receiving plate 39: holding fitting 40: switching cover 41: first fuel supply port 42: second fuel supply port 43: fuel pipe 44: main check valve 45: fuel filler inlet (manual valve) 46: relief valve 47: fuel drawing pipe 48: filter 49: pressure regulator 50: lock-off valve 51. flowmeter 52: air pump 53: air pipe 54: drain pipe 55: manual valve

[Document Name] Abstract

[Abstract]

[OBJECT] To provide an electric motor-operated vehicle with a fuel cell and its related devices securely held to the vehicle body and protected against external forces while accomplishing a compact layout by effectively utilizing the vehicle body space.

[SOLUTION] An electric motor-operated vehicle 1 comprising: a seat 3 located in about the center of a vehicle body 2, a loading platform 9 located behind the seat 3 to hold baggage, main frame rails 7 disposed in the longitudinal direction and in the lower part of the vehicle body 2, a loading platform receiving frame 14 connected to the main frame rails 7, an electric motor 36 for driving the vehicle 1, batteries 27 for supplying power to the electric motor 36, a fuel cell 30 for charging the batteries 27, fuel tanks 25 connected to the fuel cell 30, and an electric motor controller 37 for drive-controlling the electric motor 36, wherein the fuel cell 30, batteries 27, and fuel tanks 25 are mounted laterally inside the right and left side rails 14a, 14b of the loading platform receiving frame 14.

[Selected Drawing] FIG. 7

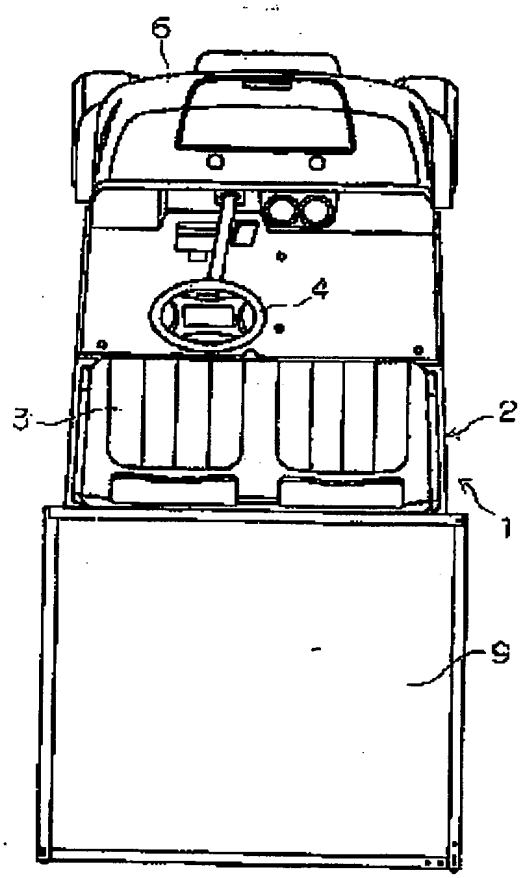


FIG. 1

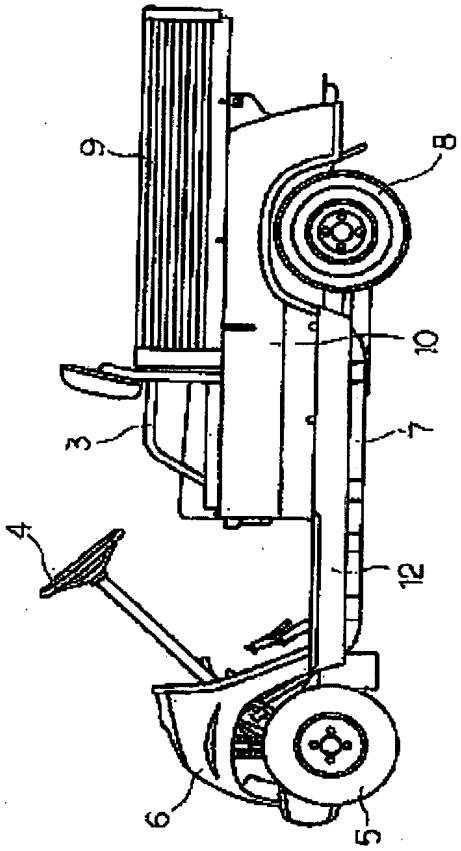


FIG. 2

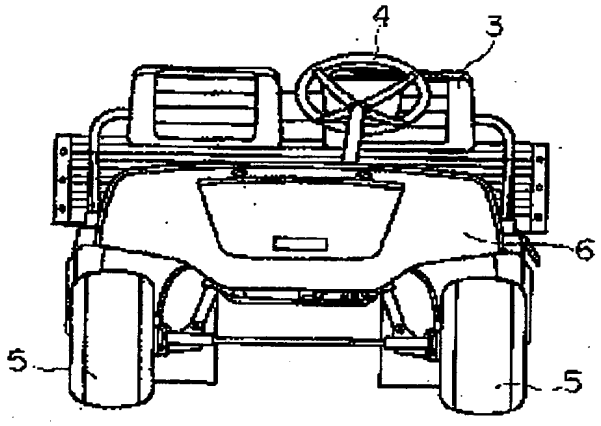


FIG. 3

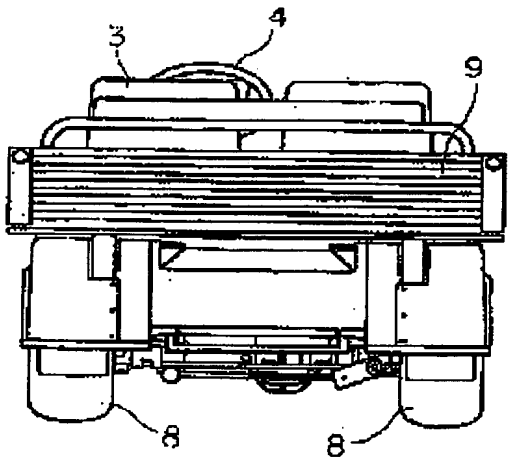


FIG. 4

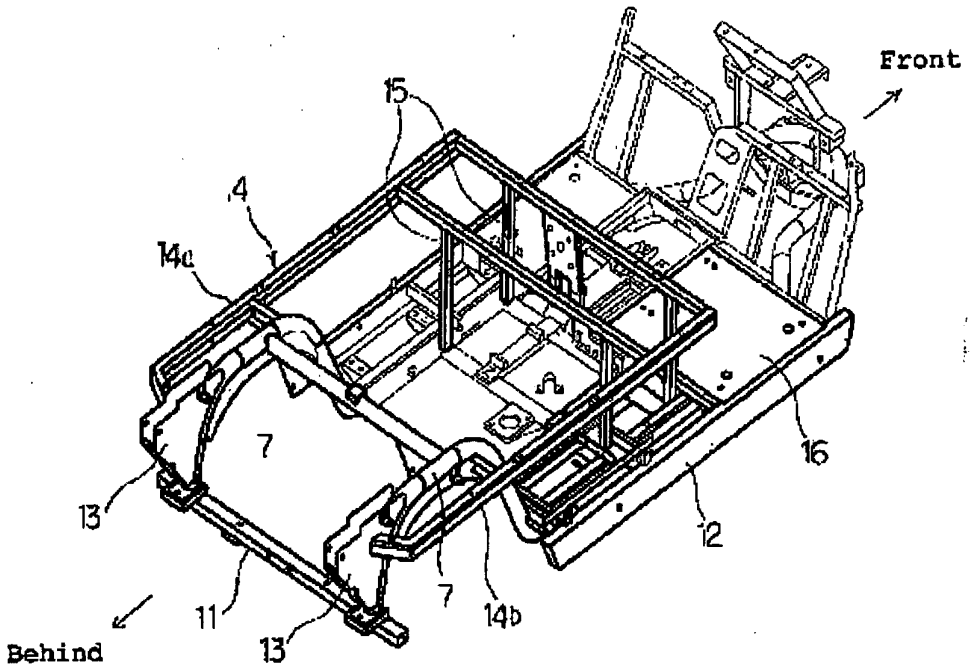


FIG. 5

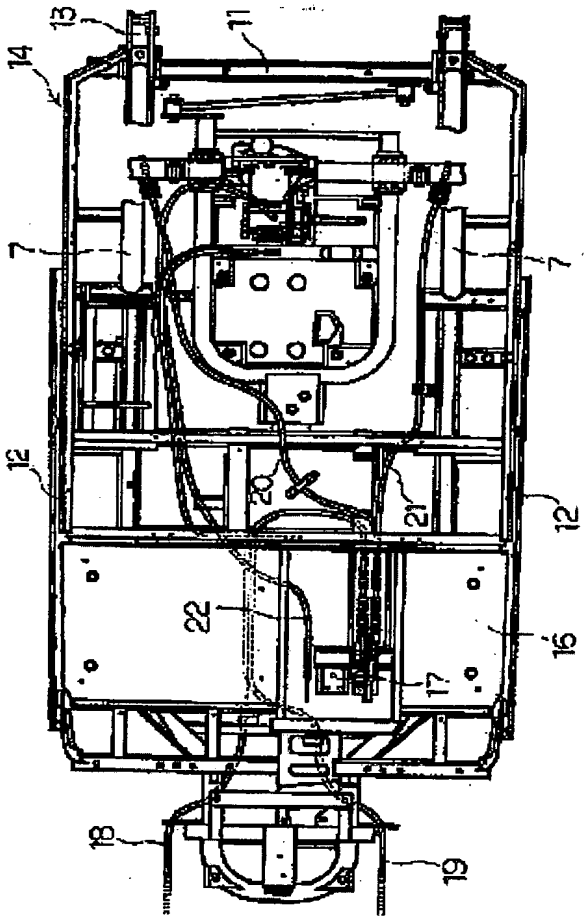


FIG. 6

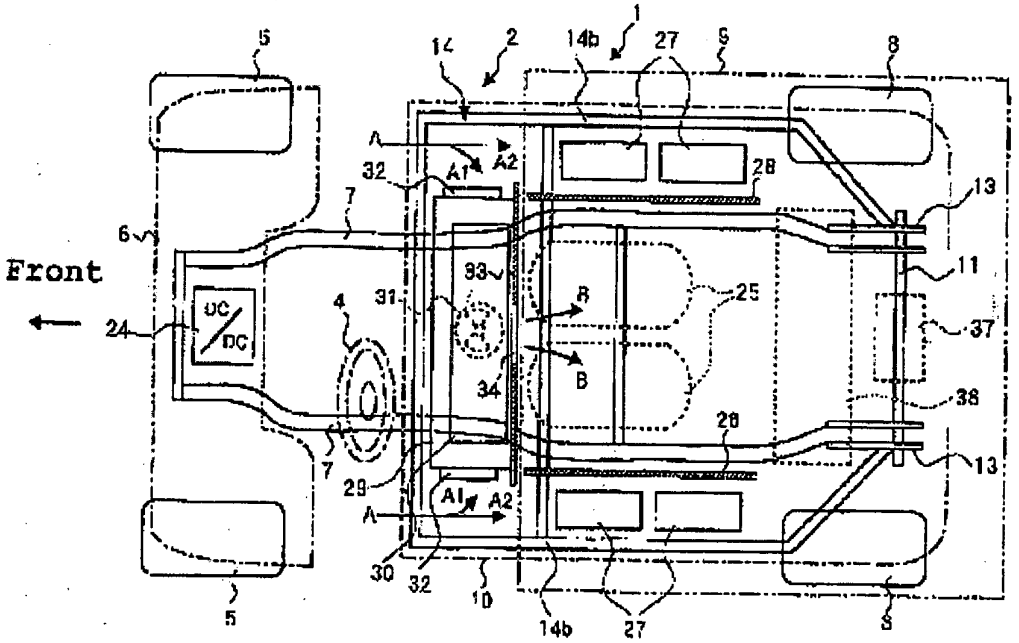


FIG. 7

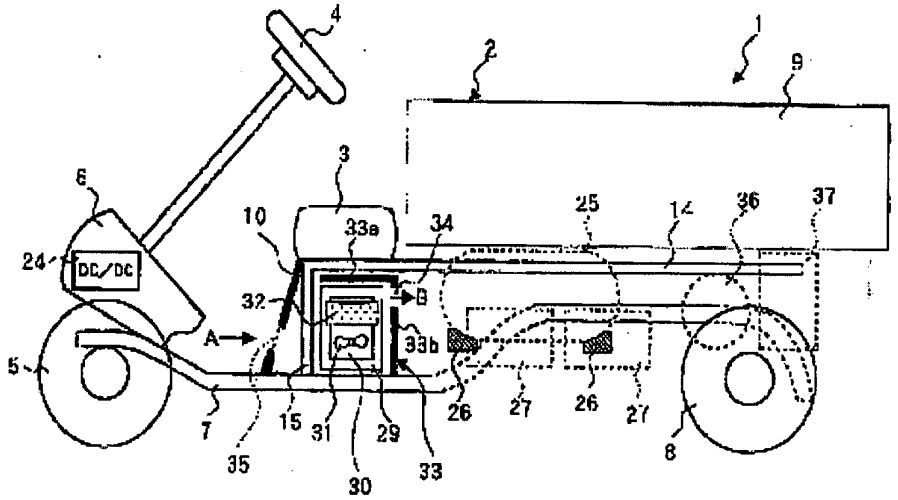

4
1
2
9
3
6
10
33a
34
25
14
36
37
24
DC/DC
32
B
A
33b
5
7
15
31
29
26
27
26
27
8
35
30
33

FIG. 8

FIG. 9

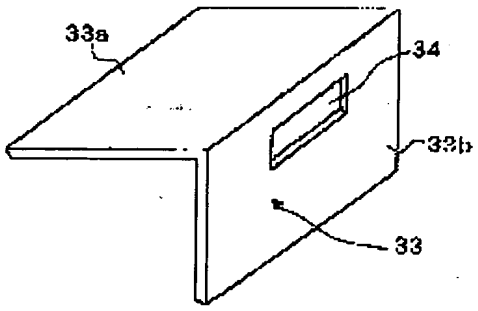


FIG. 10

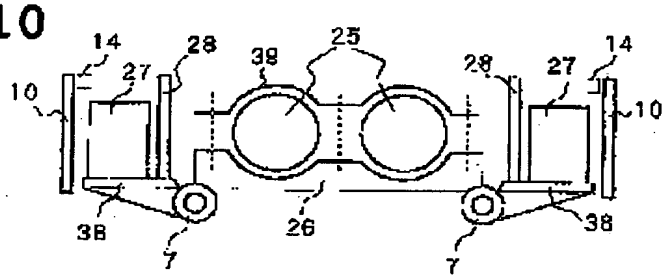
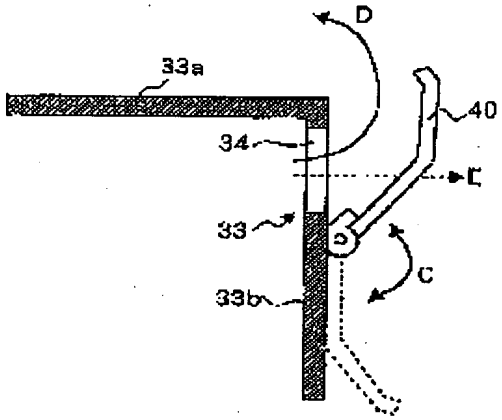
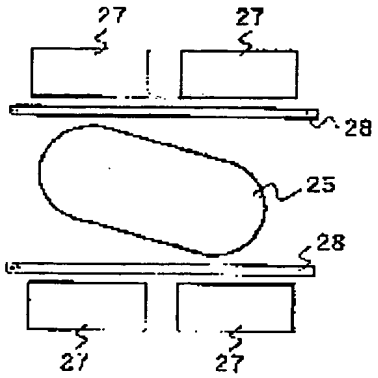


FIG. 11



(A)



(B)

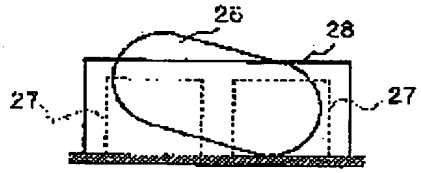


FIG. 12

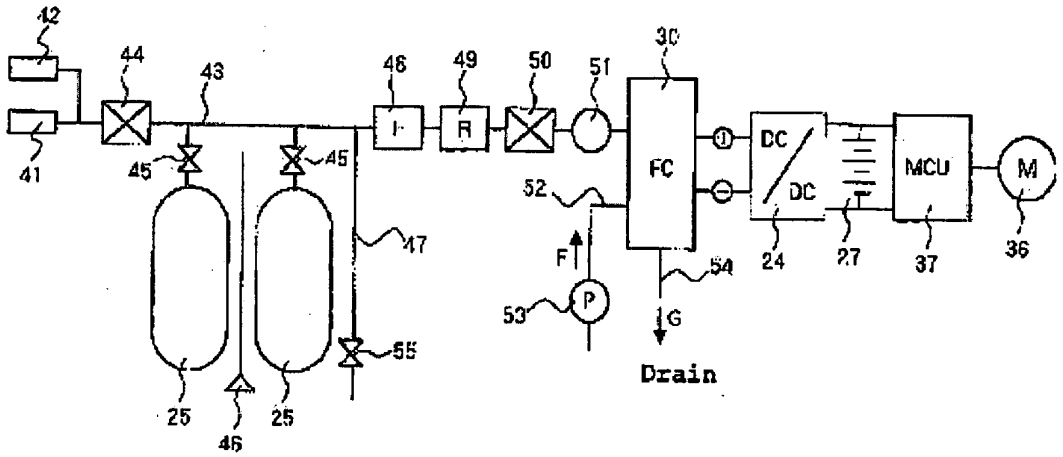

42
41
44
43
45
45
46
49
50
51
30
FC
52
F
53
P
54
G
Drain
47
55
25
46
25
I
R
DC
DC
MCU
M
24
27
37
36

FIG. 13

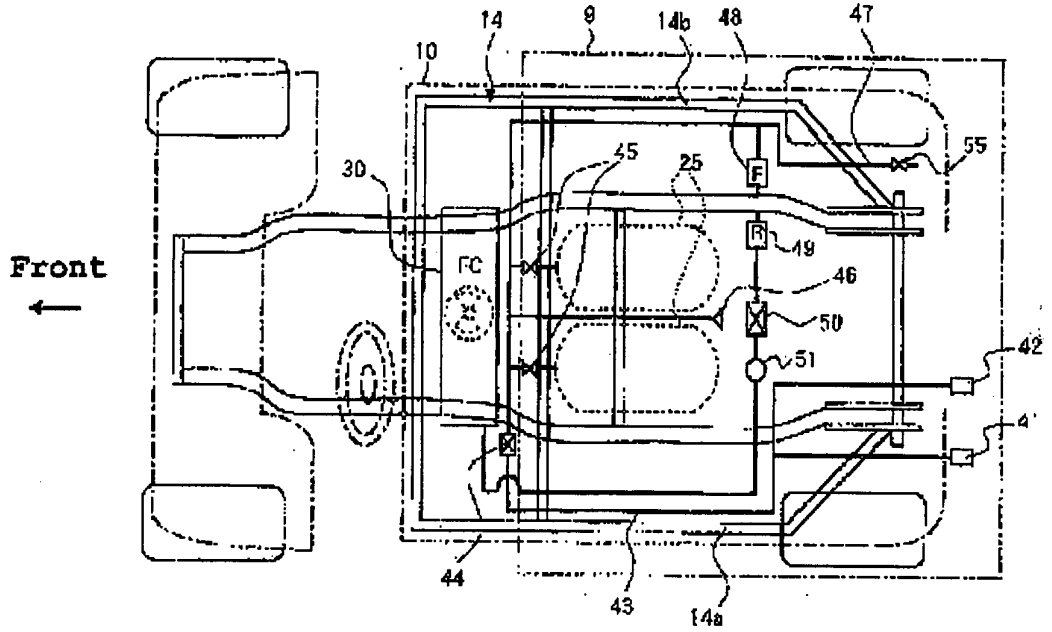


FIG. 14

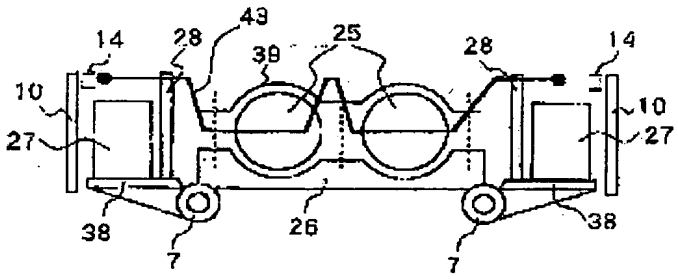


FIG. 15

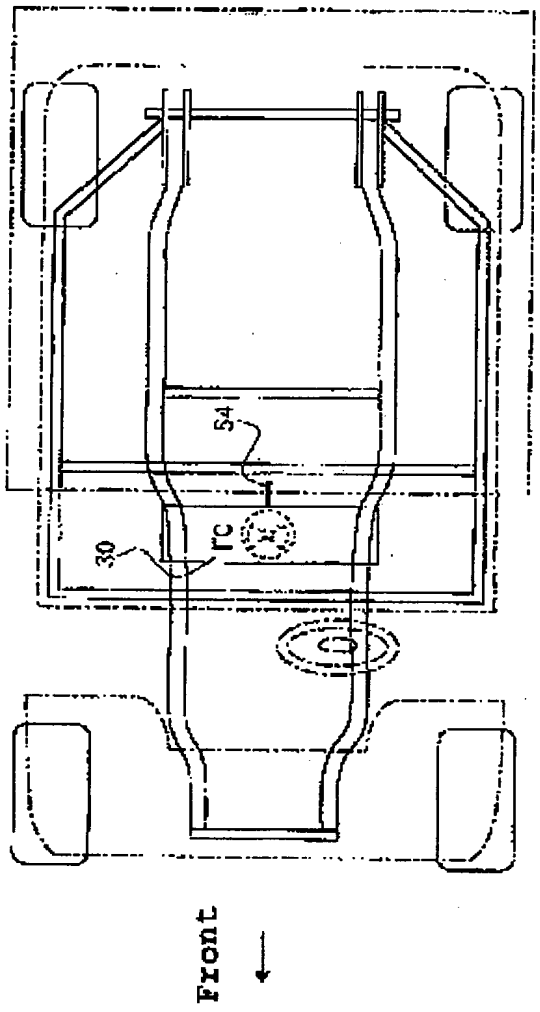


FIG. 16

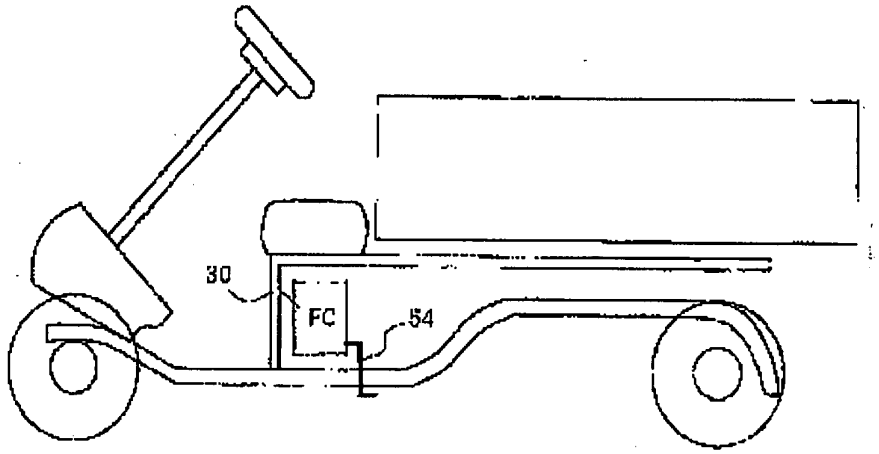


FIG. 17

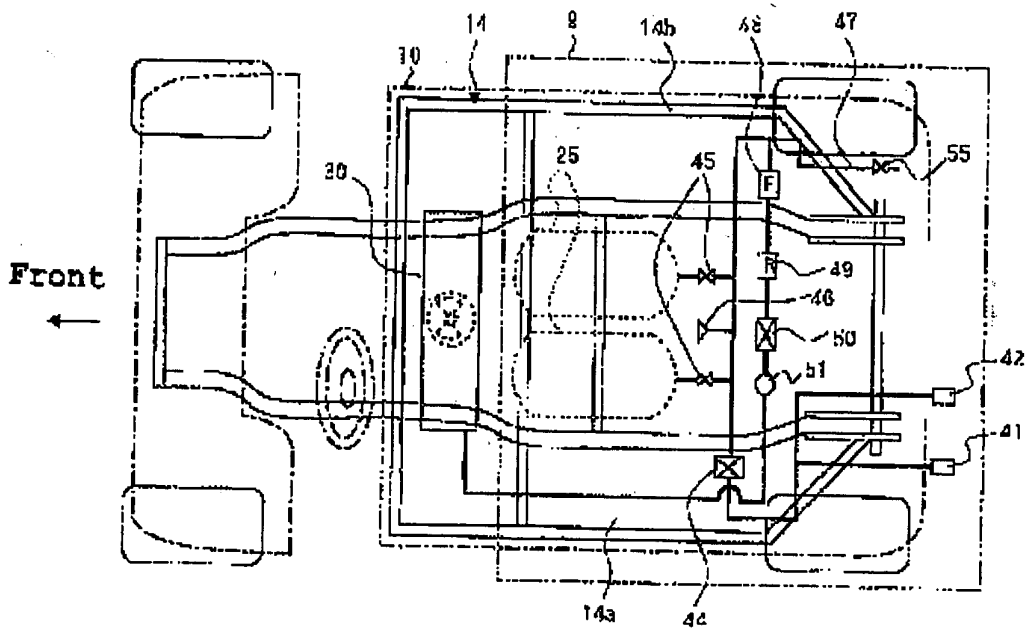


FIG. 18

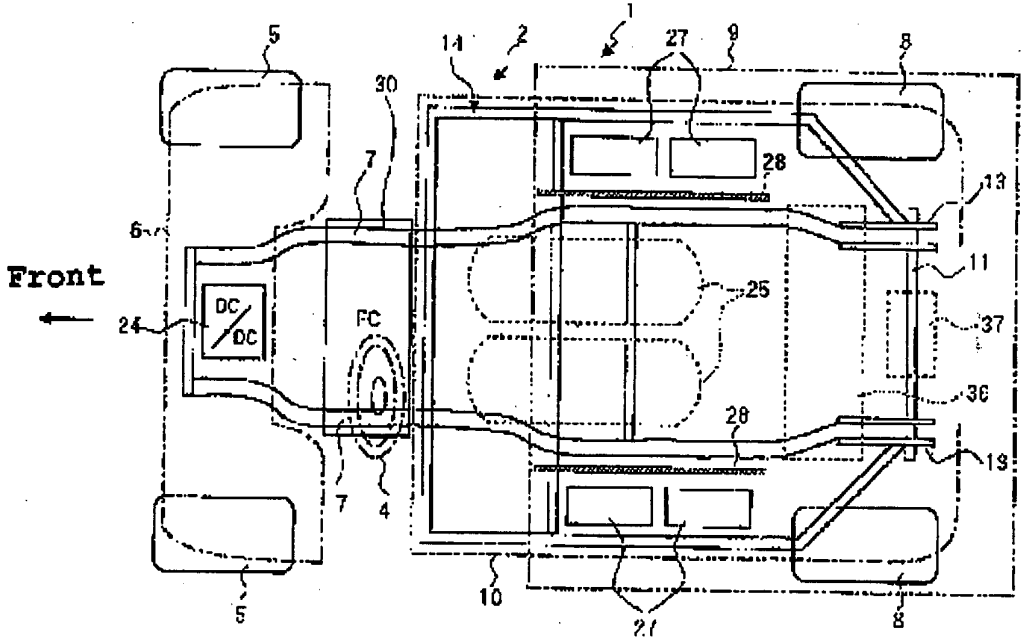


FIG. 19

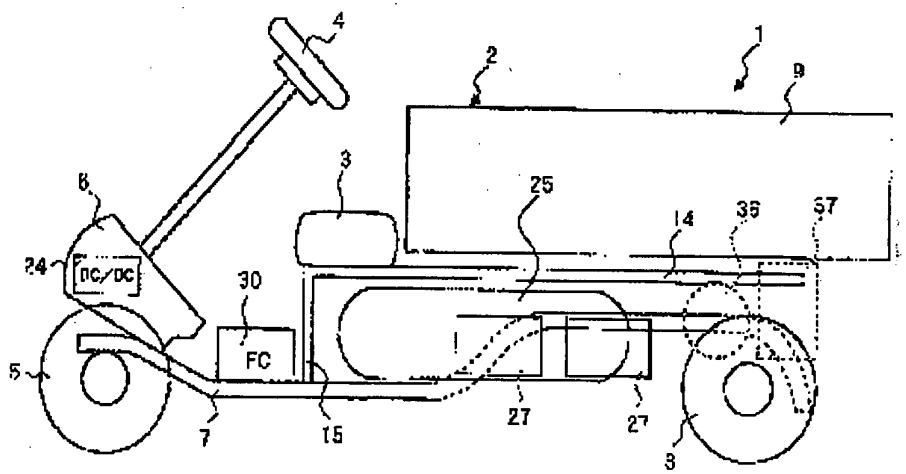


FIG. 20

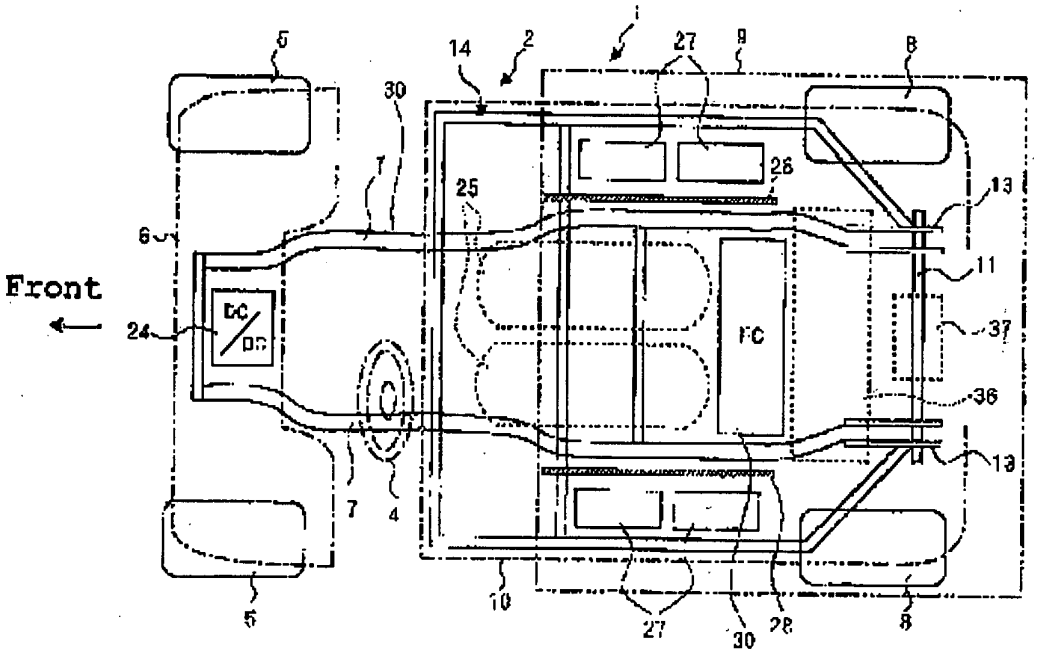


FIG. 21

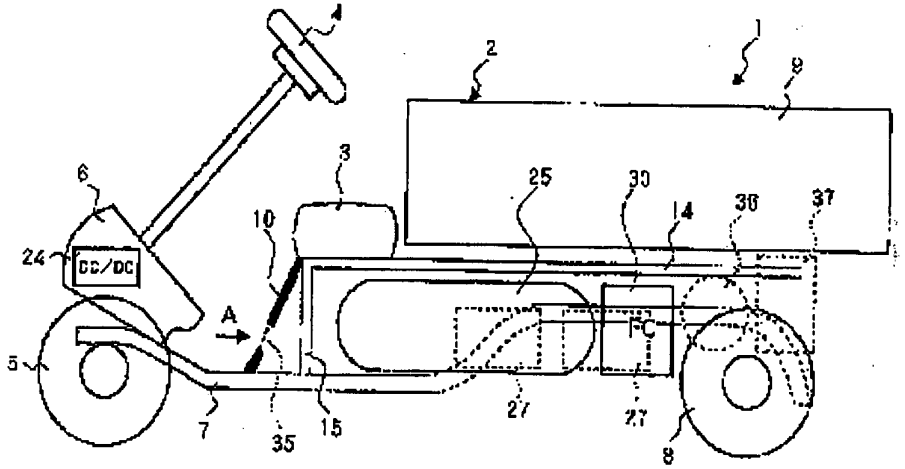


FIG. 22

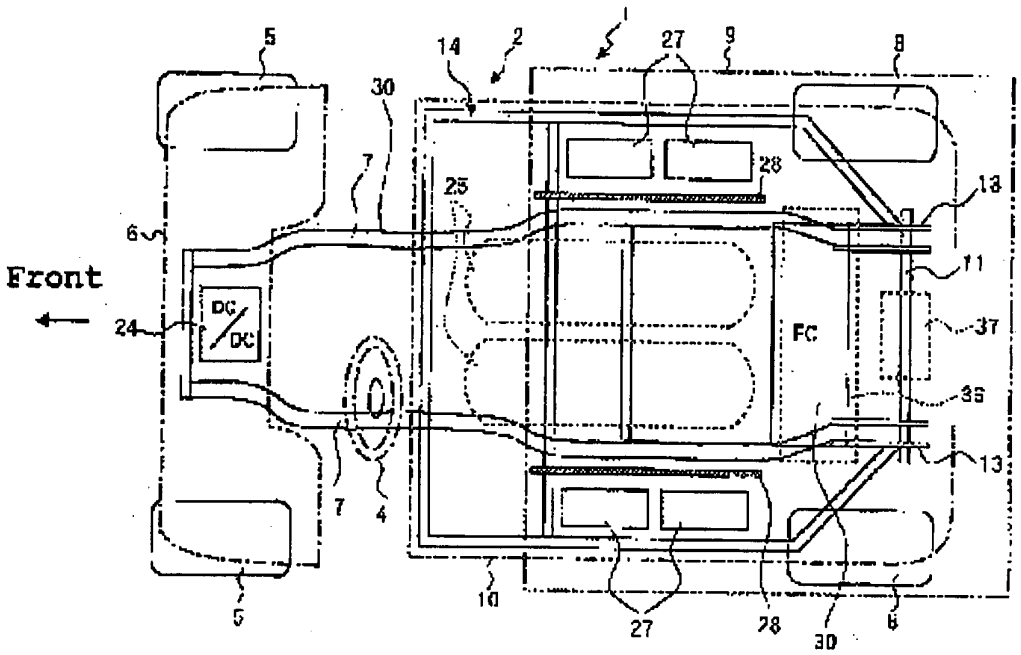


FIG. 23

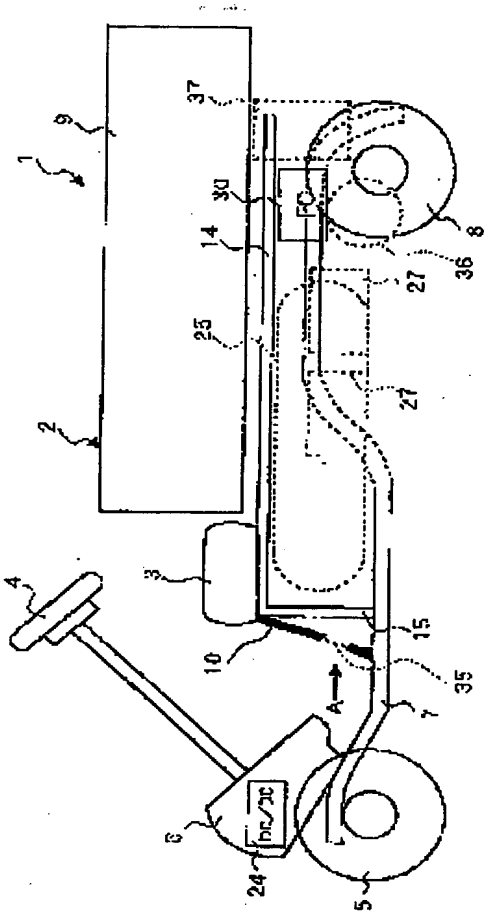


FIG. 24